

1      Claims:

2

3      1. A protective coating for use on a surface of an article in a corrosive  
4      environment, consisting of:

5      a polycrystalline diamond film material made by chemical vapor deposition  
6      having a thermal conductivity greater than 1000 W/mK and a Raman Full Width  
7      at Half Maximum of less than 10 cm<sup>-1</sup>, said diamond film material having a  
8      thickness not greater than 150 microns.

9

10     2. A protective coating according to claim 1, wherein:

11        said diamond film material has a thickness between 5 and 40 microns.

12

13     3. A protective coating according to claim 1, wherein:

14        said diamond film material is transparent to infrared radiation.

15

16     4. A protective coating according to claim 1, wherein:

17        said diamond film material has a Raman Full Width at Half Maximum of  
18      less than 5 cm<sup>-1</sup>.

19

20     5. A protective coating according to claim 1, further comprising:

21        a dopant added to said polycrystalline diamond film material to increase its  
22      electrical conductivity.

23

24     6. A protective coating according to claim 5, wherein:

25        said dopant is boron.

26

1 7. An apparatus for processing a semiconductor wafer, comprising:

2 a) a processing chamber having an inner surface; and

3 b) a mandrel within said chamber and adapted to receive and hold the

4 semiconductor wafer,

5 at least one of said inner surface and said mandrel including a protective

6 coating comprising a polycrystalline diamond film material made by chemical

7 vapor deposition having a thermal conductivity greater than 1000 W/mK and a

8 Raman Full Width at Half Maximum of less than  $10 \text{ cm}^{-1}$ , said diamond film

9 material having a thickness not greater than 100 microns.

10

11 8. A apparatus according to claim 7, wherein:

12 said processing chamber includes a heat source and at least one window

13 which is substantially transparent to heat from said heat source, at least a portion of

14 said window being provided with said protective coating.

15

16 9. A processing chamber according to claim 7, wherein:

17 said mandrel is adapted to rotate about an axis within said chamber.

18

19 10. A processing chamber according to claim 7, wherein:

20 said protective coating has a Raman Full Width at Half Maximum of less

21 than  $5 \text{ cm}^{-1}$ .

22

1 11. An electrode, comprising:  
2 a) an electrically conductive body;  
3 b) a polycrystalline diamond film coating on said body, said coating having been  
4 made by chemical vapor deposition and having a thermal conductivity greater than  
5 1000 W/mK and a Raman Full Width at Half Maximum of less than 10 cm<sup>-1</sup>, said  
6 diamond coating having a thickness not greater than 40 microns; and  
7 c) a dopant in said diamond coating for increasing its electrical conductivity.

8

9 12. An electrode according to claim 11, wherein:

10 said polycrystalline diamond film has a Raman Full Width at Half Maximum  
11 of less than 5 cm<sup>-1</sup>.

12

13 13. A method of growing a thin film diamond coating which resists corrosion and  
14 erosion, said method comprising:

15 a) positioning a substrate element on a deposition mandrel in a processing  
16 chamber of a chemical vapor deposition (CVD) system  
17 b) growing a diamond coating on said substrate to a thickness of between 5 and  
18 150 microns, the diamond coating having a Raman Full Width at Half Maximum  
19 of less than 10 cm<sup>-1</sup>, and  
20 c) removing said substrate from said processing chamber.

21

22 14. A method according to claim 13, wherein:

23 said substrate is maintained at a temperature of greater than 700°C.

24

25 15. A method according to claim 13, wherein:

26 said diamond coating is grown at a rate of between 0.5 and 6.0 microns per  
27 hour.

1

2 16. A method according to claim 13, wherein:

3       said diamond coating has a thermal conductivity greater than 1000 W/mK.

4

5 17. A method according to claim 13, wherein:

6       said diamond coating has a Raman Full Width at Half Maximum of less than  
7       10 cm<sup>-1</sup>.

8

9 18. A method according to claim 13, wherein:

10       said diamond coating has a Raman Full Width at Half Maximum of less than  
11       5 cm<sup>-1</sup>.